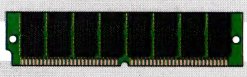
MEMORY SOLUTIONS GUIDE



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The Basics

All your files normally reside on a "mass storage device," typically a hard drive. Such devices hold tens, hundreds, or even thousands of megabytes of information. Moreover, they are non-volatile; that is, they retain this information even when the power is turned off. But the Central Processor Unit (CPU) works much faster than the hard drive can supply information, so your computer also has some fast, volatile memory made out of semiconductors. This is your Random Access Memory (RAM).

When you launch a program from your hard disk, some or all of the application software copies from the hard drive into the RAM, where the CPU can access it at high speed. When you open a document, the same thing happens. When you try to shut down your computer with documents open, the computer will ask you if you want to save them. If you answer yes, it copies the information in RAM back to the hard drive, where the computer can "remember" it even after the power is turned off.

RAM can usually access a specific piece of data about 1000 times faster than a hard drive can, but it does cost roughly 10 times as much per megabyte (MB). Consequently, a lot of effort goes into using RAM as sparingly as possible. Many computer applications are "segmented" so that only part of the software is loaded into RAM when the application launches. The rest is brought in when needed. For example, most word processors only load the spell check routines and the dictionary when you select a spell check. Some applications can also work with documents that are "partitioned," so that part of the document is in RAM and part stays on the hard drive.

All of this is done so that you can maximize the amount of work you accomplish within a given amount of "application memory," which is usually equal to the amount of RAM installed in your computer. Application memory is the space your computer uses to hold your System and applications when they are running them. You can see this space by switching into Finder, pulling down the Apple menu, and selecting "About This Macintosh..." (or "About the Finder" in System 6).

The size of the application memory space limits the combined size of the System and all the applications you can have open at the same time. You can adjust the size allocated to your applications (see "Benefits of Adding Memory"), but if you make them too small, you may not be able to use large documents.

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About ROMs

ROMs (Read Only Memory) are chips built into the computer motherboard that contain part of the operating system. Because they are Read Only, nothing more can be written on them. So they are not used as memory, like the RAM and hard drive. ROM is non-volatile and contains the information your computer must remember to start up. The computer learns a bit from the ROM, then more from the System Folder, and then much more from the rest of the hard drive.

ROMs contain many important parts of the operating system beyond the information just needed to boot the computer. The importance of ROMs in the context of memory configurations is that this operating system software can limit the amount of RAM that the computer can use.

As you browse through this guide, you may notice that certain classes of Macintosh computers have similar limitations because they use the same ROMs. For example, the Mac II, IIx, IIcx, and SE/30 need the MODE32 software to use System 7's 32-bit addressing. The LC, LC II, and Classic II ROMs limit each system's total RAM addressing to a maximum of 10MB (see "Using Large Amounts of Memory" later in this guide).

The ROMs in the Mac Plus, SE and Classic do not support 32-bit addressing at all. They are also not compatible with standard System 7 VM. They do work, however, with Connectix® Virtual™ when an accelerator card is installed. The accelerator card is needed because the main processor (the CPU) can also limit the addressing capacity of the computer (see "History of Macintosh Memory").

Benefits of Adding Memory

One advantage of having more memory is simply that you can open up more applications at the same time. Time saved not opening and closing files adds up. If you need to open up more applications than your application memory can hold, you must either install more RAM or increase your virtual memory usage. Otherwise, there just isn't enough space in application memory to do your work.

Effects of Memory on Speed

There are also circumstances where adding RAM is a good idea because it will actually speed up processing of tasks. A classic example is using an application like

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Adobe Photoshop which can work with an image that is mostly on the hard drive. Photoshop transfers images a piece at a time into RAM according to the amount of available memory. Each time data is swapped in and out of RAM, your computer becomes "I/O limited." This means the CPU is waiting around for external data transfers to occur before it can do any useful work. If you add RAM in such a situation, you can reduce the amount of disk activity and the occurrence of I/O limitations.

One way to overcome the I/O bottleneck is to use a very fast disk, like a RAM disk (see "RAM Caches, Disks, and Drives"). When you use a RAM disk, information is available as fast as the CPU can accept it, essentially so you remove I/O limits. Often, however, your computer is slower than you would like because you are "CPU-limited." The data is all available, but the CPU takes a long time to process it.

If this is the problem, more RAM will not help—you need to speed up your CPU. The five main ways to do this are: 1) add a third-party processor upgrade, 2) install an Apple CPU upgrade, 3) add a cache card, 4) add a math co-processor (which speeds up mathematical calculations only), or 5) buy a new, faster computer. By the way, unless you speed up your computer by at least 20%, it is hard to notice the increase, even though smaller improvements save you time.

As mentioned in the "About SIMMs" section, SIMMs come in different speeds. The current range is 70 to 150ns. If the RAM is too slow for your system, it often just won't work. But buying faster RAM will not have any effect on the speed performance of your Macintosh. (For speed requirements, see the "Tech Specs"section later.)

What Happens When You Have Too Little Memory?

When you try to use an application but don't have enough memory, two problems may occur. If you are really short on memory, the application may simply refuse to launch. The computer displays a dialog box that reads, "The application could not be opened." Worse, it may let you open the document, but later quit in the middle of the session displaying "Application has unexpectedly quit." Usually, you get a warning before you launch such a configuration displaying how much RAM you ought to have versus how much is actually available.

If the amount left is less than about 75% of the total normally required, you are probably risking an Unexpected Quit. If this happens, you will lose your recent changes (since the last Save). Be sure to save frequently! Some applications warn you of low memory by reversing some elements of the screen (white on black instead of black on white).

These are all signs that you need more memory for that application, but not nec-

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essarily that you need more RAM. If you are using System 7 or System 6 MultiFinder, you may just need to increase the amount of memory allocated to that application. To do this, quit the application into the Finder, click once on the application's icon so that it is selected, then press Command-I (or select "Get Info" from the Finder under the "File" menu). Increase the number located in the lower box in the bottom right-hand corner ("Application Memory Size"). Then close the Info window. You do not have to restart.

Now when you launch the application, you will have more of your application memory assigned to this application. If you want to run several applications simultaneously, and the combined size of all the applications plus the System is bigger than your total application memory, you must use virtual memory, install more RAM, or run the risk of opening an application with less than the designated partition size, possibly leading to an Unexpected Quit.

Similar limitations apply under System 6 Finder, but only if you want to run an application that, when combined with the System, requires more application memory than you have. Under System 6 Finder, the open application always gets all available memory, so the partition adjustment procedure is unnecessary.

Sometimes when you are very low on memory, printing will not work properly—some fonts may not come out right. If there is no other way to get more memory, a quick trick is to use Background Printing (selected from the Chooser). Save your document and start printing as normal. Immediately after sending the job to the printer, quit the application. Wait until printing is finished before opening another application.

Portable and PowerBook Issues

On the Portable and PowerBooks, extended battery life can be a further benefit to adding memory. Most applications are segmented, meaning that only part of the software comes up from the hard drive when the application is launched. The rest is brought into RAM whenever the computer needs code in another segment (or other program resources). On a Portable, this means that a launched application is often still forcing the hard drive to keep spinning, even after it is launched, because the application is frequently calling new segments. The hard drive uses a lot of battery power.

With more memory installed, you can use three tricks to save the battery. First, some applications let you force the whole program to load into RAM at once. Go into the Preferences box and look for selectors that say "Keep Program in Memory" or "Keep File in Memory."

Another way to extend battery life is to install Connectix PowerBook Utilities.

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This improves your ability to control and monitor battery use, as well as to maintain the battery. PowerBook Utilities also offers a complete set of utilities designed exclusively for PowerBooks, including security, cursor finder, hot keys, instant sleep and wake, and an LCD screen saver.

For even longer battery life use Spiral, a unique software product for PowerBooks, from TechWorks. Spiral is a note-taking/organizational software application that resides totally within memory. The only time you access the hard disk is when you Save. What this means is that your battery will last longer with every charge. For more information about Spiral or any other TechWorks product, call the number listed at the bottom of the page.

About SIMMs

Every Macintosh computer since the Mac Plus contains sockets or slots to hold memory and to allow for memory expansion. The standard way to add memory is to install a Single In-Line Memory Module (SIMM). A SIMM is a long, thin printed circuit board (PCB) with a single row of RAM chips on it. Some computers (Portable, PowerBooks, and Classics) use non-standard RAM boards that install into "slots."

Installing RAM is fairly easy. Many leading SIMM vendors include detailed written installation instructions with their RAM. Often, the hardest part is figuring out how to open your computer. If you don't want to do it yourself, your local Apple dealer will probably do it for a nominal charge.

You should be very careful, however, when installing RAM in the Plus, SE, Classic, Classic II or SE/30. The built-in video monitor can hold a dangerous electrical charge for quite a while after the power is turned off. SIMM installation on these computers requires a special tool (a size 3/32" Hex tool tip screwdriver) and a higher level of experience than on the other systems. You may also have to cut a resistor or move a jumper.

There are basically four rules you need to know for deciding what kind of SIMMs to purchase and where to install them.

The Four SIMM Rules

There are three classes of computers in terms of memory architecture: Compact (closed), Modular (open), and Portable. The Compact computers have built-in monitors. The Modular computers are all the systems with separate monitors. The Portables include the original Portable, the PowerBooks and the PowerBook Duos.

Each class has its own basic memory architecture. (For a comprehensive system-by-system discussion of RAM configurations, see "Tech Specs" later in this guide). This architecture usually consists of some RAM soldered onto the motherboard, plus several SIMM sockets clustered in one or more "banks." (Each bank may also only contain one SIMM socket.) Knowing about this architecture is important because of the way the banks must be filled.

Rule #1: Each SIMM bank must either be completely full or empty.

Rule #2: Each SIMM bank must be filled with SIMMs of the same size.

SIMMs come in different sizes. Not long ago, there were only two common types: 256K (one quarter megabyte) and 1MB (one megabyte). Today there are 256K, 512K, 1MB, 2MB, 4MB, 8MB, 16MB and 32MB SIMMs, and even larger ones on the way.

On many Macintosh computers, you can put different sized SIMMs in different banks, but within each bank, mixing is not possible.

Some SIMM sizes will not work in all computers. For example, 2MB SIMMs only work in the LC, LC II, IIsi, IIci, Performa 400 and 600 and Quadra 900/950. And, 1MB SIMMs made of two chips instead of the usual eight usually do not work on the Mac II, IIx, Plus and SE.

SIMMs come in different speeds. They are rated according to how fast information can be retrieved from them. This access speed is denoted in "ns" (ns stands for nanosecond, a billionth of a second). Compact computers generally need 150ns or faster SIMMs. Some computers need 120 or 100ns or faster, but the others demand 80ns or 60ns. The ns number can usually be found on the RAM chip itself.

You can use faster SIMMs (a lower ns number) than required but they will not improve performance. The advantage of buying over-rated SIMMs is that they may still be compatible if you upgrade, or if you buy a new computer. Slower speeds are becoming harder to find.

Physically, most SIMMs are interchangeable. However, there are some exceptions. You must distinguish between the 8-bit, 32-bit, and IIfx, SIMMs which are not interchangeable. Portable RAM is completely different. Because of the power limitations, special RAM called "Static" or "Pseudo-Static" RAM is required. It's more expensive, but necessary. Powerbook RAM is machine-specific and is not interchangeable. Some

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modules work in more than one machine, but not all machines. Portable and PowerBook RAM are not interchangeable either.

Rule #3: If you only fill one bank with SIMMs, use Bank A.

When you face the front of the two-bank Modular computers, the four SIMM sockets on the right are usually Bank A, probably the opposite of what you would guess. On the Mac Plus and the early SE (the one that uses resistors for memory configuration), the two sockets towards the back are Bank A. On the later SE (the one that uses jumpers) and the SE/30, Bank A is towards the front. On the Quadra 900/950, Bank A is the upper left two sockets and the two sockets below them.

You can use SIMMs of different sizes in the different banks as long as each bank is of one SIMM type. If you do this, remember the following rule:

Rule #4: You should usually put your largest SIMMs in Bank A.

Notice we said usually. If you start working with SIMMs that are bigger than 1MB, things can get more complicated (see "Using Large Amounts of Memory"). In particular, this rule is reversed if you use 4, 8, or 16MB SIMMs and either have a Mac II, Mac IIx, or use on-board video on a IIci. This also applies to 2MB SIMMs on the IIci with on board video. (2MB SIMMs don't work on the Mac II and IIx.)

Using Large Amounts of Memory

Things are pretty simple on any Portable computer, on a Modular computer (as long as you don't need more than 8MB of memory), or on a Compact Mac (if you are satisfied with 4MB). In this case, just follow the four SIMM rules (discussed earlier). But, if you are doing high-end graphics, animation, CAD, modeling, or any of the plethora of memory-intensive computer jobs, then you may need special software to use a lot of memory.

Operating System Memory Limitations

The main issue is that when you install more memory in your Macintosh computer, the operating system sometimes does not recognize that the memory is there. In particular, the 24-bit addressing mode (standard on System 6, optional on System 7) can use only 8MB of memory on a Modular computer, or 4MB on a Compact computer.

The two basic ways to deal with this on a Modular computer are to use 32-bit addressing (see next subsection) or enhanced 24-bit addressing (follows next subsection). The 32-bit addressing mode lets a Modular computer use up to 256MB of RAM,

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while the enhanced 24-bit mode extends 24-bit addressing from 8MB to 14MB.

The 68000-based Compact computers, the Plus, SE, and Classic, cannot use 32-bit addressing. The 68030-based Classic II and the SE/30 work like Modular computers in terms of 24- and 32-bit addressing, so the following two subsections also apply to them.

32-Bit Addressing

32-bit addressing is a feature of System 7 that increases the amount of application memory you can address (use). It is not related to 32-bit QuickDraw, 32-bit color, or how many colors can show on your screen or video image.

An address is a unique serial number that identifies the location of each byte of information in application memory. Every Modular computer since the Mac II has been built with hardware that can use 32 bits (a binary number 32 digits long, such as 11010010010100100101001010111011) for addresses, but, until recently, the operating system has only used the first 24 bits. This "24-bit mode" limited the computer to using a maximum of 16MB of addressable memory, of which the lower 8MB is assigned to application memory, and the upper 8MB is assigned to NuBus cards, ROMs, and various other devices (see "History of Macintosh Memory" later in this guide).

When 32-bit addressing is turned on, the system uses all 32 digits for address information, meaning that it can identify up to 4 billion locations (4 gigabytes). This totally eliminates the 8-megabyte limit.

There are still some hardware limitations in the SIMM socket design, so you can install only 128 megabytes of physical memory (eight 16MB SIMMs) on some Modular computers and up to 256MB on later Macs, like the Quadras. That is the maximum physical RAM you can use as application memory under 32-bit addressing.

Still, for most people, 128MB to 256MB of physical RAM is more than enough. The easiest way to get this is to run System 7 with 32-bit addressing turned on. To find out if 32-bit addressing is available, look in the Memory control panel.

If you have an early Modular computer (II, IIx, IIcx, or SE/30) running System 7, just install MODE32 and you can do exactly the same thing. Modular computer users (except Quadra users) that are running System 6 can get 32-bit mode by installing Connectix OPTIMA™. OPTIMA is not compatible with MultiFinder, so you can use only the Finder.

32-bit addressing is not available on the Mac Plus, SE, or Classic, but Compact Virtual™ 3.0 supports 16MB of physical or virtual memory if a 68030 processor upgrade is installed. TechWorks offers low-cost processor upgrades for the Classic and the SE. (An LC version is due soon.) They are available in 16, 25 and 33MHz and all

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have optional FPUs. Call TechWorks for more information.

There is no 32-bit addressing or other high memory solution for the Portable or PowerBook 100. Although the PowerBooks 140, 145, 145B and 170 can use 32-bit addressing mode, there is little point because total installed RAM is limited physically to 8MB. The PowerBooks 160, 165, 165c, 180, 180c and Duos can benefit from 32-bit addressing mode.

32 bit addressing is limited on the Classic II, LC, and LC II to 10MB by the ROMs in these systems. So, for example, if you put two 4MB SIMMs into a Classic II, you have a total of 12MB (including the built-in 4MB). But you can only use 10MB, even in 32 bit addressing mode, because of the ROMs.

Sometimes you cannot use 32-bit addressing because an application, extension, control panel or software built into some peripheral device is not compatible with this mode. Then, you must use 24-bit addressing (see the next section).

32 bit addressing is imperceptibly faster than 24-bit addressing. The only significant speed improvement comes if it lets you eliminate I/O bottlenecks by your adding more memory (see "Benefits of Adding Memory").

24-Bit Addressing

24-bit mode is the standard addressing mode of System 6 and is also what you get under System 7 when 32-bit addressing is off or is not available. In standard 24-bit mode, normally you are able only to use 8MB out of the total RAM available as application memory on a Modular Mac.

Note that any of the 24-bit memory over eight megabytes on a Modular Mac will be fragmented so that no single application can use all the available memory under MultiFinder. In 32-bit mode, all memory up to one gigabyte is contiguous so that each application can access all the application memory.

RAM Caches, Disks, and Drives

We described how information has to be brought from the hard drive into RAM before the CPU can use it. Once executed, you can push these instructions out of RAM if the space is required to hold other information. Then, if these instructions are needed again, the system must copy them again from the hard drive. But the system uses instructions, often repeatedly, in short intervals ("loops" in the program, for example). So, the computer contains a built-in adjustable RAM cache, where the SIMM RAM can store information that was recently brought up from the hard drive. This speeds up

access when the system needs recently used information right away.

You can change the size of this cache in the control panel. However, increasing the RAM cache beyond some point, typically 128K, yields diminishing returns, and becomes a waste of potential application memory. The RAM cache is worth using, but don't expect dramatic results. Usually, it speeds things up no more than 5 to 15%.

The Macintosh computer uses this caching technique for two other reasons in caches that get progressively smaller, faster, and closer to the core of the processor itself. Firstly, some computers support an add-on memory cache, which can remember a small number of recently used instructions. It stores them in special RAM that the CPU can access even faster than data held in SIMM RAM. Memory caches produce surprisingly big speed improvements, often in the range of 15 to 30%. And because you add RAM, this cache does not reduce the amount of available application memory. Call now to find out how TechWorks' cache cards for the IIci, IIsi, LCIII, Quadra and Centris machines can help improve your computer's performance.

Secondly, the processor itself often has a built-in cache that stores a very small number of recently used instructions. The 68020 has a 256-byte cache for instructions, the 68030 has two 256-byte caches (one for instructions and one for data), and the 68040 has two 4-kilobyte (4K) caches. (The 68000 does not have one.) Surprisingly, though 256-bytes is not enough space to hold even this one paragraph, the 68020 cache contains the information sought by the processor about 20% of the time. Computers do a lot of repetitive work!

A RAM disk is a portion of the installed RAM that is not used for application memory, and instead is configured to work like a hard drive. RAM disks typically look like a hard drive on the desktop. You can add, access, modify, or remove information in the same way as a hard drive, but at RAM speeds. RAM disks are a good place for large files that are frequently accessed. However, users should be aware that most RAM disks lose their information when you shut down or the machine crashes.

Bad Memory

When you power up your computer (perform a "cold start"), it performs a comprehensive memory test. Basically, it tries to write information to all the address locations in the entire installed RAM and then performs an operation (called an XOR) on the contents to see if it produces the correct result. It then writes the opposite pattern (0's where there were 1's before and vice versa) and tests again. If it gets correct results both times, it validates the RAM. When you do a Restart (a "warm boot") without interrupting power, the computer performs a much more limited test.

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In either case, if the computer finds a problem before it validates enough memory to run the monitor, it gives a four-note chime, colorfully known as the "Chimes of Death." If it finds a problem after it validates enough memory to run the monitor, you get the unhappy computer image on the screen (along with codes that might show a programmer something about what went wrong).

There are several possible explanations for a startup problem. If you have just changed the RAM configuration in your computer, or have just moved the computer, it probably means the RAM is not securely seated in the SIMM sockets or slots. Try wiggling each SIMM a little and gently pressing it a little harder into the socket. If this doesn't help, carefully remove the SIMMs and put them back in. If you still have problems, make sure you followed the Four SIMM Rules (listed earlier), have the right RAM for your machine (for example, PAL SIMMs for a II or IIx if they are over 1 MB), and don't have any obvious other culprits (like a loose add-on accelerator card). If possible, try to start your computer with a different set of RAM and then use a process of swapping and elimination to determine if you have a bad SIMM. SIMMs don't go bad often, but when they do, it is usually because of improper handling.

It is possible for software to cause memory problems, too, although this is extremely rare. If your RAM seems to be okay, try turning off as many extensions as possible, reinstalling your System and running a virus checker.

History of Macintosh Memory

Addressing modes affect how you use your computer because they determine the amount of application memory you can use on your system. Application memory is the space your system works in when it runs applications, the memory you can see described under "About This Macintosh..." The size of this space limits the total combined size of all the applications you can have open at the same time. The System also uses up application memory.

The amount of RAM that your system can "address" (use) as application memory is limited by the total number of different memory addresses (locations) that the Macintosh computer can identify, each with a unique serial number. Your computer performs this identification by sending 1's and 0's down a parallel set of data lines called an address bus.

This address bus became an important limitation during the course of the evolution of the Macintosh computer. Apple's Macintosh system software was first devel-

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oped on the Lisa and Mac128 computers, both of which used the Motorola 68000 microprocessor. Although the internal architecture of the machine used 32-bit address and data paths, this microprocessor only had a 24-line address bus, so no address higher than 224 (about 16 million) was accessible. The 24-bit addressing scheme did not use the top byte (the top eight bits) out of the total 32. So, this 24-bit addressing mode of the Macintosh computer only supported 16 megabytes of internal addresses.

This 24-bit/16-megabyte limitation was accentuated by another design decision made in the early computer architecture. Of those 16 megabytes, only the lower four were allocated to support RAM addresses, hence the "4-megabyte barrier" familiar to users of Compact Macintosh computers. The remaining upper 12 megabytes were allocated to address the motherboard, video monitors, ROMs, and input/output ports like SCSI and AppleTalk.

The 24-bit addressing mode did not seem like a big limitation on the earliest computers, which had only 128K of RAM. So, the enterprising software engineers used the unused top byte to signify various other things. For example, setting the high-order bits of an address could help "tag" (identify) that memory as being temporarily non-relocatable. Thus, the hexadecimal address $80001234 represents the same memory location as $00001234, but is just tagged differently. The operating system, the ROM code, and the applications that were developed to run on the Macintosh computer used this invention throughout. And, as you will see, this led to later problems.

Eventually, the 4-megabyte barrier started to become a significant limitation and Apple began to convert the Macintosh hardware, software, and firmware (ROMs) to the 32-bit mode. For the foreseeable future, the internal limitations of RAM addressing would cease to exist. (Unfortunately, this memory is also fragmented—at the 1-gigabyte level. As a result, the system can access "only" 1 gigabyte of application memory under System 7's 32-bit mode. Because, historically, upper-level Macintosh memory needs have doubled every year this should become an issue in the near future.)

The first step of this conversion program was to incorporate a new microprocessor. With the introduction of the Motorola 68020-based Mac II (and the later 68030-based systems), the Macintosh CPU graduated to a 32-bit address bus. The hardware could make all 32-bits of each address significant.

The 68020 (and later the 68030 and 68040) computers also featured an improved 24-bit mode. The ROM addresses occur at 8MB (instead of 4MB on the earlier computers), so these new modular computers could immediately support up to 8MB of RAM.

Now the software became a problem. Some of the high-order address bits had been set for non-address purposes, so whenever the hardware used those particular

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tagged" addresses, the program would fetch information from an incorrect location; that is, although the hardware was now 32-bit clean, the system, the embedded code in the ROMs, and much of the application software was not. At this point, Apple started to clean up their system software and ROM designs, and tried to impress upon third-party developers the importance of following Apple guidelines, so the software everyone wrote would work in a full-time 32-bit clean environment when the ROMs and System were ready.

The second step of the conversion program was the new "32-bit clean" ROM designs. These were first released in 1989 and could accept full 32-bit addresses. Systems equipped with these ROMs can run in 32-bit mode under System 7 and later systems, if the applications and extensions are 32-bit clean. The function of Connectix MODE32 is to make this 32-bit mode available for users of Mac II family computers released before the 32-bit clean ROMs were introduced, that is the SE/30, II, IIx, and IIcx. MODE32 contains software that makes these ROMs 32-bit clean.

Apple's third step was to convert the operating system itself to run in this mode, a feature that is provided as the 32-bit mode option in System 7. One can guess that in some future System the 24-bit option may disappear entirely, and 32-bit mode will be the standard.

The last step in moving to 32-bit mode involves the application software. You can use only "32-bit clean" applications in 32-bit mode—all others will cause a system crash. Apple made 32-bit mode optional in System 7 because some applications today are incompatible with 32-bit mode, and it will probably be a while before the full software base converts. When you want to run applications and/or extensions that are not 32-bit clean, you must switch your system to the 24-bit mode.

The remainder of this guide lists the technical specifications of all Macintosh computers from the Macintosh Plus to the AV machines. It also lists specifications for all the Macintosh laptops, the Newton, and various LaserWriters.

TechWorks would like to thank Connectix for their cooperation in developing the preceding text describing memory product applications and advantages.

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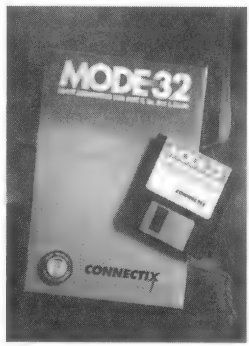
Discover the line of

VIRTUAL 3.0 This is the innovative program that brought virtual memory to the Macintosh. It provides Macintosh users with an inexpensive method of increasing internal memory without adding expensive RAM. Version 3.0 is faster, more compatible, and can use less disk space than virtual memory (VM) being offered in System 7 software. It's the choice of Mac users who want high-performance virtual memory that is compatible with both System 6 and System 7.

MAXIMA 2.0 This is the versatile memory extension utility for Macintosh systems with more than 8MB of RAM. The protected non-volatile RAM disk is the perfect place to store large, frequently used documents. It survives Shutdowns, Restarts, and even crashes. And Maxima creates 14MB of enhanced 24-bit addressing. Use 4MB SIMMs without dealing with compatibility issues of 32-bit addressing mode. Works with System 6 and 7.

MODE32 This unique software enables use of the standard System 7 32-bit addressing on Mac II, IIx, IIcx or SE/30. MODE32 lets you access up to one full gigabyte of virtual memory, or as much physical RAM as you can put in your Macintosh. MODE32 is now available for unrestricted use worldwide through a special distribution agreement between Apple Computer and Connectix.



OPTIMA Combine the advantages of 32-bit addressing with the speed of System 6! Ideal for Photoshop, XPress, Color Studio, Studio/32 and other memory intensive applications that need up to 32MB of contiguous application memory for a single application. OPTIMA/128 also available- creates up to 128MB of contiguous application memory. Optima is the only solution to create 32-bit addressing mode on Mac II-class machines with System 6 Finder.

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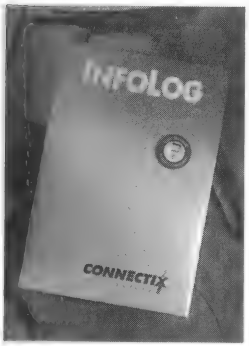
Connectix products

CPU This is the complete integrated solution for enhancing PowerBook productivity and convenience. Effortlessly stretch your battery life, secure your sensitive files, preserve your LCD screen, and give your trackball-weary thumbs a rest! CPU is simple to use with built-in settings that are perfect for Home, Office, Travel or anywhere. CPU provides all this and over a dozen other controls. Put more power into your PowerBook with CPU.



InfoLog This is the unique Fortune 500 tested system for managing documents and other information. It lets you tag, log, file, retrieve and use over 100,000 important resources. InfoLog creates a shared system that allows anyone in your organization to locate and use information they need, even if the person who filed it is unavailable. InfoLog puts the information you need at your fingertips.

HAND-Off II MacWEEK and MacUser love this indispensable utility for fast, easy file access. SuperMenu turns the System 7 Apple menu into a multi-level hierarchy for launching, opening and browsing folders and files. Pop-up menus, automatic compatible application substitution, color depth and sound level switching, and document briefcases save you time.

MC73 PMMU This memory coprocessor (Paged Memory Management Unit) allows users of original Mac IIs to use virtual memory. MC73 comes with a grounding strap and an easy-to-follow installation manual.

800-950-5880

CONNECTIX

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Maximize your RAM investment

MAXIMA is the unique RAM enhancement utility. It gives you access to large amounts of RAM without using 32-bit addressing and also creates a powerful RAM disk. For Macintosh computers with more than eight megabytes of RAM, MAXIMA is the productivity tool that lets you get even more out of your memory investment.

For RAM that is not used as application memory, MAXIMA creates a protected non-volatile RAM disk (24 or 32-bit compatible). This RAM disk survives system crashes, shutdowns and restarts. Information that has been changed since the last Shutdown is automatically copied back to your hard drive before you shut off your Mac.

MAXIMA's RAM disk will reduce restart time, accelerate many routine operations and speed up memory-intensive applications. Macintosh systems with exactly 8MB of memory can also take advantage of the RAM disk by using System 7 in 32-bit addressing mode.

MAXIMA can extend System 6 and 7's 24-bit addressing capacity to 14MB. For applications which cannot yet address large amounts of memory through 32-bit addressing, MAXIMA creates enhanced 24-bit addressing, allowing access to much needed application memory. MAXIMA is ideal

for those Macintosh applications which are not yet 32-bit clean. With MAXIMA, you can run more programs at the same time. You'll be more productive and avoid the limitations of a memory-starved Mac.

Put MAXIMA to work on your Mac. Call your software supplier or Connectix at (800) 950-5880 or (415) 571-5100.

800-950-5880

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TECH SPECS

Technical Specifications for
Macintosh Computers
and TechWorks Products.

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MAC PLUS

TECH SPECS

Processor Information/General Information	
Machine:	Mac Plus
Processor:	68000
Speed:	8MHz
Memory Information	
Memory-Logic Board:	1MB (SIMM)
SIMM Slots:	4
SIMM Type:	8-bit, 30-pin
Speed:	150ns or Faster
# of SIMMs Added @ a Time:	2
Memory Configurations:	1, 2, 2.5, 4MB
Video RAM Information	
Video RAM On-Board:	N/A
VRAM Slots:	N/A
VRAM Type:	N/A
Speed:	N/A
VRAM Configurations:	N/A
On-Board FPU:	No
On-Board Cache:	No
Expansion Slots:	None
Ethernet:	SCSI Adapter

TechWorks Products	
Descriptions	**Part Number**
1MB SIMM	10274

MAC SE

TECH SPECS

Processor Information/General Information	
Machine:	Mac SE
Processor:	68000
Speed:	8MHz
Memory Information	
Memory-Logic Board:	1MB (SIMM)
SIMM Slots:	4
SIMM Type:	8-bit, 30-pin
Speed:	150ns or Faster
# of SIMMs Added @ a Time:	2
Memory Configurations:	1, 2, 2.5, 4MB
Video RAM Information	
Video RAM On-Board:	N/A
VRAM Slots:	N/A
VRAM Type:	N/A
Speed:	N/A
VRAM Configurations:	N/A
On-Board FPU:	No
On-Board Cache:	No
Expansion Slots:	1
Ethernet:	SCSI Ethernet Adapter

TechWorks Products	
Descriptions	**Part Number**
1MB SIMM	10274

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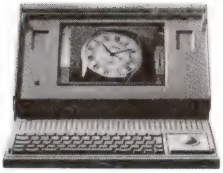
Mac Portable



Tech Specs

Processor Information/General Information	
Machine:	Mac Portable
Processor:	68000
Speed:	8MHz
Memory Information	
Memory-Logic Board:	1MB (SIMM)
SIMM Slots:	1
SIMM Type:	Expansion Card
Speed:	100ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	1, 2, 3, 4MB
Video RAM Information	
Video RAM On-Board:	N/A
VRAM Slots:	N/A
VRAM Type:	N/A
Speed:	N/A
VRAM Configurations:	N/A
On-Board FPU:	No
On-Board Cache:	No
Expansion Slots:	1
Ethernet:	SCSI Ethernet Adapter

TechWorks Products	
Descriptions	**Part Number**
3MB Portable Memory Expansion Card	10314

Mac Classic

Tech Specs

Processor Information/General Information	
Machine:	Mac Classic
Processor:	68000
Speed:	8MHz
Memory Information	
Memory-Logic Board:	1MB (SIMM)
SIMM Slots:	1
SIMM Type:	Expansion Card
Speed:	100ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	1, 2, 2.5, 4MB
Video RAM Information	
Video RAM On-Board:	N/A
VRAM Slots:	N/A
VRAM Type:	N/A
Speed:	N/A
VRAM Configurations:	N/A
On-Board FPU:	No
On-Board Cache:	No
Expansion Slots:	None
Ethernet:	SCSI Ethernet Adapter

TechWorks Products	
Descriptions	**Part Number**
1MB Classic Memory Expansion Card	10326
3MB Classic Memory Expansion Card	10318

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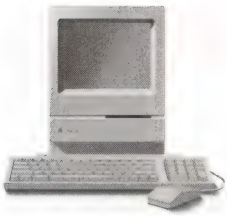
Mac Classic II

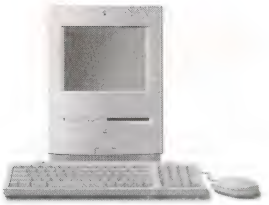


TECH SPECS

Processor Information/General Information	
Machine:	Mac Classic II
Processor:	68030
Speed:	16MHz
Memory Information	
Memory-Logic Board:	2MB (SIMMs)
SIMM Slots:	2
SIMM Type:	8-bit, 30-pin
Speed:	100ns or Faster
# of SIMMs Added @ a Time:	2
Memory Configurations:	2, 4, 6, 10MB
Video RAM Information	
Video RAM On-Board:	N/A
VRAM Slots:	N/A
VRAM Type:	N/A
Speed:	N/A
VRAM Configurations:	N/A
On-Board FPU:	No, Upgrade Available
On-Board Cache:	No
Expansion Slots:	None
Ethernet:	SCSI Ethernet Adapter

TechWorks Products	
Descriptions	**Part Number**
1MB SIMM	10274
2MB SIMM	10291
4MB SIMM	10286
16MHz Classic II FPU	10334

Mac Color Classic



Tech Specs

Processor Information/General Information	
Machine:	Mac Color Classic
Processor:	68030
Speed:	16MHz
Memory Information	
Memory-Logic Board:	4MB
SIMM Slots:	2
SIMM Type:	8-bit, 30-pin
Speed:	100ns or Faster
# of SIMMs Added @ a Time:	2
Memory Configurations:	4, 6, 8, 10MB
Video RAM Information	
Video RAM On-Board:	256K
VRAM Slots:	1
VRAM Type:	256K SIMM
Speed:	80ns or Faster
VRAM Configurations:	256K, 512K
On-Board FPU:	Optional
On-Board Cache:	No
Expansion Slots:	None
Ethernet:	Ethernet Adapter Card

TechWorks Products	
Descriptions	**Part Number**
1MB SIMM	10274
2MB SIMM	10291
4MB SIMM	10286
256K VRAM SIMM	10299
16MHz FPU	10062

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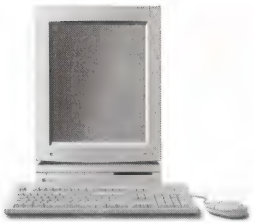
Mac LC

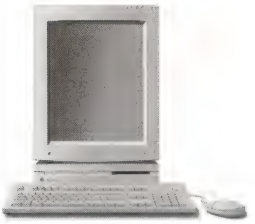


TECH SPECS

Processor Information/General Information	
Machine:	Mac LC
Processor:	68020
Speed:	16MHz
Memory Information	
Memory-Logic Board:	2MB
SIMM Slots:	2
SIMM Type:	8-bit, 30-pin
Speed:	100ns or Faster
# of SIMMs Added @ a Time:	2
Memory Configurations:	2, 4, 6, 10MB
Video RAM Information	
Video RAM On-Board:	256K
VRAM Slots:	1
VRAM Type:	256K SIMM
Speed:	100ns or Faster
VRAM Configurations:	256K, 512K
On-Board FPU:	No
On-Board Cache:	No
Expansion Slots:	1-PDS
Ethernet:	Ethernet Adapter Card

TechWorks Products	
Descriptions	**Part Number**
1MB SIMM	10274
2MB SIMM	10291
4MB SIMM	10286
256K VRAM SIMM	10299
16MHz FPU	10332

Mac LC II



TECH SPECS

Processor Information/General Information	
Machine:	Mac LC II
Processor:	68030
Speed:	16MHz
Memory Information	
Memory-Logic Board:	2MB or 4MB
SIMM Slots:	2
SIMM Type:	8-bit, 30-pin
Speed:	100ns or Faster
# of SIMMs Added @ a Time:	2
Memory Configurations:	2, 4, 6, 10MB
Video RAM Information	
Video RAM On-Board:	256K
VRAM Slots:	1
VRAM Type:	256K SIMM
Speed:	100ns or Faster
VRAM Configurations:	256K, 512K
On-Board FPU:	No
On-Board Cache:	No
Expansion Slots:	1-PDS
Ethernet:	Ethernet Adapter Card

TechWorks Products	
Descriptions	**Part Number**
1MB SIMM	10274
2MB SIMM	10291
4MB SIMM	10286
256K VRAM SIMM	10299
16MHz FPU	10332

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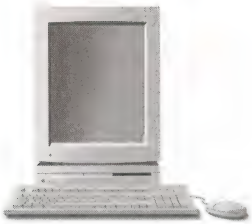
Mac LC III

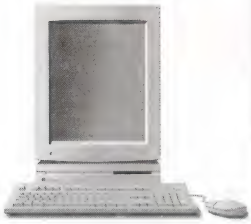


TECH SPECS

Processor Information/General Information	
Machine:	Mac LC III
Processor:	68030
Speed:	25MHz
Memory Information	
Memory-Logic Board:	4MB
SIMM Slots:	1
SIMM Type:	32-bit, 72-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	4, 5, 6, 8, 12, 20, 36MB
Video RAM Information	
Video RAM On-Board:	512K
VRAM Slots:	1
VRAM Type:	256K SIMM
Speed:	100ns or Faster
VRAM Configurations:	512K, 768K
On-Board FPU:	Yes
On-Board Cache:	No
Expansion Slots:	1-PDS
Ethernet:	Not Built-In

TechWorks Products	
Descriptions	**Part Number**
4MB SIMM	10373
8MB SIMM	10374
16MB SIMM	10828
32MB SIMM	10829
256K VRAM SIMM	10299
25MHz FPU	10567-0005

MAC LC 475



TECH SPECS

Processor Information/General Information	
Machine:	Mac LC 475
Processor:	68040
Speed:	25MHz
Memory Information	
Memory-Logic Board:	4MB
SIMM Slots:	1
SIMM Type:	32-bit, 72-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	4, 5, 6, 8, 12, 20, 36MB
Video RAM Information	
Video RAM On-Board:	512K
VRAM Slots:	2
VRAM Type:	512K SIMM
Speed:	80ns or Faster
VRAM Configurations:	512K, 1MB
On-Board FPU:	Optional
On-Board Cache:	No
Expansion Slots:	1-PDS
Ethernet:	Ethernet Adapter Card

TechWorks Products	
Descriptions	**Part Number**
4MB SIMM	10373
8MB SIMM	10374
16MB SIMM	10828
32MB SIMM	10829
512K VRAM SIMM	10288

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MAC LC 520

TECH SPECS

Processor Information/General Information	
Machine:	Mac LC 520
Processor:	68030
Speed:	25MHz
Memory Information	
Memory-Logic Board:	4MB
SIMM Slots:	1
SIMM Type:	32-bit, 72-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	4, 8, 12, 20, 36MB
Video RAM Information	
Video RAM On-Board:	512K
VRAM Slots:	1
VRAM Type:	256K SIMM
Speed:	80ns or faster
VRAM Configurations:	512K, 768K
On-Board FPU:	Optional
On-Board Cache:	No
Expansion Slots:	1-PDS
Ethernet:	Ethernet Adapter Card

TechWorks Products	
Descriptions	**Part Number**
4MB SIMM	10373
8MB SIMM	10374
16MB SIMM	10828
32 MB SIMM	10829
256K VRAM SIMM	10299
25MHz FPU	10567-0005

Mac IIsi

Tech Specs

Processor Information/General Information	
Machine:	Mac IIsi
Processor:	68030
Speed:	20MHz
Memory Information	
Memory-Logic Board:	1MB
SIMM Slots:	4
SIMM Type:	8-bit, 30-pin
Speed:	100ns or Faster
# of SIMMs Added @ a Time:	4
Memory Configurations:	1, 2, 3, 5, 9, 17MB
Video RAM Information	
Video RAM On-Board:	N/A
VRAM Slots:	N/A
VRAM Type:	N/A
Speed:	N/A
VRAM Configurations:	N/A
On-Board FPU:	Optional
On-Board Cache:	No
Expansion Slots:	1-PDS
Ethernet:	Ethernet Adapter Card

TechWorks Products	
Descriptions	**Part Number**
1MB SIMM	10274
2MB SIMM	10291
4MB SIMM	10286
Adapter with FPU	10482

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Mac IIci

TECH SPECS

Processor Information/General Information	
Machine:	Mac IIci
Processor:	68030
Speed:	25MHz
Memory Information	
Memory-Logic Board:	4MB (SIMMs)
SIMM Slots:	8
SIMM Type:	8-bit, 30-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	4
Memory Configurations:	4, 8, 12, 16, 20, 24, 32, 64, 128MB
Video RAM Information	
Video RAM On-Board:	N/A
VRAM Slots:	N/A
VRAM Type:	N/A
Speed:	N/A
VRAM Configurations:	N/A
On-Board FPU:	Yes
On-Board Cache:	No
Expansion Slots:	3
Ethernet:	Ethernet Adapter Card

TechWorks Products	
Descriptions	**Part Number**
1MB SIMM	10274
2MB SIMM	10291
4MB SIMM	10286
8MB SIMM	10295
16MB SIMM	10300

MAC II

TECH SPECS

Processor Information/General Information	
Machine:	Mac II
Processor:	68020
Speed:	16MHz
Memory Information	
Memory-Logic Board:	1MB (SIMM)
SIMM Slots:	8
SIMM Type:	8-bit, 30-pin
Speed:	100ns or Faster
# of SIMMs Added @ a Time:	4
Memory Configurations:	1, 2, 4, 8, 16, 32MB
Video RAM Information	
Video RAM On-Board:	N/A
VRAM Slots:	N/A
VRAM Type:	N/A
Speed:	N/A
VRAM Configurations:	N/A
On-Board FPU:	No
On-Board Cache:	No
Expansion Slots:	4
Ethernet:	Ethernet Adapter Card

TechWorks Products	
Descriptions	**Part Number**
1MB SIMM	10274
4MB SIMM	10292

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Mac IIx

TECH SPECS

Processor Information/General Information	
Machine:	Mac IIx
Processor:	68030
Speed:	16MHz
Memory Information	
Memory-Logic Board:	1MB (SIMM)
SIMM Slots:	8
SIMM Type:	8-bit, 30-pin
Speed:	100ns or Faster
# of SIMMs Added @ a Time:	4
Memory Configurations:	1, 2, 4, 8, 16, 32MB
Video RAM Information	
Video RAM On-Board:	N/A
VRAM Slots:	N/A
VRAM Type:	N/A
Speed:	N/A
VRAM Configurations:	N/A
On-Board FPU:	Yes
On-Board Cache:	No
Expansion Slots:	4
Ethernet:	Ethernet Adapter Card

TechWorks Products	
Descriptions	**Part Number**
1MB SIMM	10274
4MB SIMM	10292

Mac IIcx

TECH SPECS

Processor Information/General Information	
Machine:	Mac IIcx
Processor:	68030
Speed:	16MHz
Memory Information	
Memory-Logic Board:	1MB (SIMM)
SIMM Slots:	8
SIMM Type:	8-bit, 30-pin
Speed:	100ns or Faster
# of SIMMs Added @ a Time:	4
Memory Configurations:	1, 2, 4, 8, 16, 20, 32MB
Video RAM Information	
Video RAM On-Board:	N/A
VRAM Slots:	N/A
VRAM Type:	N/A
Speed:	N/A
VRAM Configurations:	N/A
On-Board FPU:	Yes
On-Board Cache:	No
Expansion Slots:	3
Ethernet:	Ethernet Adapter Card

TechWorks Products	
Descriptions	**Part Number**
1MB SIMM	10274
4MB SIMM	10287

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MAC IIFX

TECH SPECS

Processor Information/General Information	
Machine:	Mac IIfx
Processor:	68030
Speed:	40MHz
Memory Information	
Memory-Logic Board:	4MB (SIMMs)
SIMM Slots:	8
SIMM Type:	32-bit, 64-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	4
Memory Configurations:	4, 8, 16, 20, 32, 64, 128MB
Video RAM Information	
Video RAM On-Board:	N/A
VRAM Slots:	N/A
VRAM Type:	N/A
Speed:	N/A
VRAM Configurations:	N/A
On-Board FPU:	Yes
On-Board Cache:	No
Expansion Slots:	6
Ethernet:	Ethernet Adapter Card

TechWorks Products	
Descriptions	**Part Number**
1MB SIMM	10278
4MB SIMM	10287
8MB SIMM	10294
16MB SIMM	10293

Mac IIvx

TECH SPECS

Processor Information/General Information	
Machine:	Mac IIvx
Processor:	68030
Speed:	33MHz
Memory Information	
Memory-Logic Board:	4MB
SIMM Slots:	4
SIMM Type:	8-bit, 30-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	4
Memory Configurations:	4, 5, 8, 20, 36, 68MB
Video RAM Information	
Video RAM On-Board:	512K
VRAM Slots:	2
VRAM Type:	512K SIMM
Speed:	80ns or Faster
VRAM Configurations:	512K, 1MB
On-Board FPU:	Yes
On-Board Cache:	Yes
Expansion Slots:	3
Ethernet:	Ethernet Adapter Card

TechWorks Products	
Descriptions	**Part Number**
1MB SIMM	10274
4MB SIMM	10286
16MB SIMM	10300
512K VRAM SIMM	10288

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Mac Centris 610

Tech Specs

Processor Information/General Information	
Machine:	Mac Centris 610
Processor:	68040
Speed:	20MHz
Memory Information	
Memory-Logic Board:	4MB
SIMM Slots:	2
SIMM Type:	32-bit, 72-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	4, 8, 12, 16, 20, 24, 28, 36, 40, 44, 52, 68MB
Video RAM Information	
Video RAM On-Board:	512K
VRAM Slots:	2
VRAM Type:	256K SIMM
Speed:	80ns or Faster
VRAM Configurations:	512K, 1MB
On-Board FPU:	Yes
On-Board Cache:	Yes
Expansion Slots:	2
Ethernet:	Ethernet Adapter Card

TechWorks Products	
Descriptions	**Part Number**
4MB SIMM	10373
8MB SIMM	10374
16MB SIMM	10828
32MB SIMM	10829
256K VRAM SIMM	10299

MAC CENTRIS 650

TECH SPECS

Processor Information/General Information	
Machine:	Mac Centris 650
Processor:	68040
Speed:	25MHz
Memory Information	
Memory-Logic Board:	4MB or 8MB (SIMMs)
SIMM Slots:	4
SIMM Type:	32-bit, 72-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	4, 8, 12, 16, 20, 24, 28, 36, 40, 44, 48, 52, 56, 60, 68, 72, 76, 84, 88, 92, 100, 104, 108, 116, 132MB
Video RAM Information	
Video RAM On-Board:	512K
VRAM Slots:	2
VRAM Type:	256K SIMM
Speed:	80ns or Faster
VRAM Configurations:	512K, 1MB
On-Board FPU:	Yes
On-Board Cache:	Yes, 8K
Expansion Slots:	3
Ethernet:	Ethernet Adapter Card

TechWorks Products	
Descriptions	**Part Number**
4MB SIMM	10373
8MB SIMM	10374
16MB SIMM (Non-Composite)	10828
32MB SIMM	10829
256K VRAM SIMM	10299

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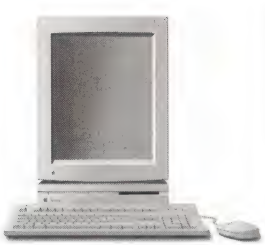
MAC CENTRIS 660AV

TECH SPECS

Processor Information/General Information	
Machine:	Mac Centris 660AV
Processor:	68040
Speed:	25MHz
Memory Information	
Memory-Logic Board:	4MB
SIMM Slots:	2
SIMM Type:	32-bit, 72-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	4, 8, 12, 16, 20, 24, 28, 36, 40, 44, 48, 52, 56, 68MB This machine has 4MB soldered on the logic board and one 4MB SIMM installed in one SIMM slot.
Video RAM Information	
Video RAM On-Board:	1MB
VRAM Slots:	0
VRAM Type:	N/A
Speed:	N/A
VRAM Configurations:	1MB
On-Board FPU:	Yes
On-Board Cache:	Yes, 8K
Expansion Slots:	1-NuBus (Requires NuBus Adapter)
Ethernet:	Built-In Ethernet, FriendlyNet Connector

TechWorks Products	
Descriptions	**Part Number**
4MB SIMM	10373
8MB SIMM	10374
16MB SIMM	10828
32MB SIMM	10829

Mac Quadra 605



Tech Specs

Processor Information/General Information	
Machine:	Mac Quadra 605
Processor:	68040
Speed:	25MHz
Memory Information	
Memory-Logic Board:	4MB
SIMM Slots:	1
SIMM Type:	32-bit, 72-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	4, 8, 12, 20, 36MB
Video RAM Information	
Video RAM On-Board:	512K
VRAM Slots:	2
VRAM Type:	512K SIMM
Speed:	80ns or Faster
VRAM Configurations:	512K, 1MB
On-Board FPU:	Optional
On-Board Cache:	Yes, 8K
Expansion Slots:	1
Ethernet:	Optional

TechWorks Products	
Descriptions	**Part Number**
4MB SIMM	10373
8MB SIMM	10374
16MB SIMM	10828
32MB SIMM	10829
512K VRAM SIMM	10288

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Mac Quadra 610

Tech Specs

Processor Information/General Information	
Machine:	Mac Quadra 610
Processor:	68040
Speed:	25MHz
Memory Information	
Memory-Logic Board:	4MB
SIMM Slots:	2
SIMM Type:	32-bit, 72-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	4, 8, 12, 16, 20, 24, 28, 36, 40, 44, 52, 68MB
Video RAM Information	
Video RAM On-Board:	512K
VRAM Slots:	2
VRAM Type:	256K SIMM
Speed:	80ns or Faster
VRAM Configurations:	512K, 1MB
On-Board FPU:	Optional
On-Board Cache:	Yes, 8K
Expansion Slots:	1
Ethernet:	Optional

TechWorks Products	
Descriptions	**Part Number**
4MB SIMM	10373
8MB SIMM	10374
16MB SIMM	10828
32MB SIMM	10829
256K VRAM SIMM	10299

Mac Quadra 650

Tech Specs

Processor Information/General Information	
Machine:	Mac Quadra 650
Processor:	68040
Speed:	33MHz
Memory Information	
Memory-Logic Board:	4MB or 8MB (SIMMs)
SIMM Slots:	4
SIMM Type:	32-bit, 72-pin
Speed:	60ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, 52, 56, 60, 64, 68, 72, 76, 80, 84, 88, 92, 96, 108, 116, 132, 136MB
Video RAM Information	
Video RAM On-Board:	512K
VRAM Slots:	2
VRAM Type:	256K SIMM
Speed:	80ns or Faster
VRAM Configurations:	512K, 1MB
On-Board FPU:	Optional
On-Board Cache:	Yes, 8K
Expansion Slots:	3
Ethernet:	Built-In

TechWorks Products	
Descriptions	**Part Number**
4MB SIMM	10373
8MB SIMM	10374
16MB SIMM	10828
32MB SIMM	10829
256K VRAM SIMM	10299

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Mac Quadra 660AV

Tech Specs

Processor Information/General Information	
Machine:	Mac Quadra 660AV
Processor:	68040
Speed:	25MHz
Memory Information	
Memory-Logic Board:	4MB
SIMM Slots:	2
SIMM Type:	32-bit, 72-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	4, 8, 12, 16, 20, 24, 28, 36, 40, 44, 48, 52, 56, 68MB This machine has 4MB soldered on the logic board and one 4MB SIMM installed in one SIMM slot.
Video RAM Information	
Video RAM On-Board:	1MB
VRAM Slots:	0
VRAM Type:	N/A
Speed:	N/A
VRAM Configurations:	1MB
On-Board FPU:	Yes
On-Board Cache:	Yes, 8K
Expansion Slots:	1-NuBus (Requires NuBus Adapter)
Ethernet:	Built-In Ethernet, FriendlyNet Connector

TechWorks Products	
Descriptions	**Part Number**
4MB SIMM	10373
8MB SIMM	10374
16MB SIMM	10828
32MB SIMM	10829

Mac Quadra 700

Tech Specs

Processor Information/General Information	
Machine:	Mac Quadra 700
Processor:	68040
Speed:	25MHz
Memory Information	
Memory-Logic Board:	4MB (SIMMs)
SIMM Slots:	4
SIMM Type:	8-bit, 30-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	4
Memory Configurations:	4, 8, 20, 36, 68MB
Video RAM Information	
Video RAM On-Board:	512K
VRAM Slots:	6
VRAM Type:	256K SIMM
Speed:	80ns or Faster
VRAM Configurations:	512K, 1MB, 1.5MB, 2MB
On-Board FPU:	Yes
On-Board Cache:	Yes, 8K
Expansion Slots:	3
Ethernet:	Built-In

TechWorks Products	
Descriptions	**Part Number**
1MB SIMM	10274
4MB SIMM	10286
16MB SIMM	10300
256K VRAM SIMM	10299

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Mac Quadra 800

Tech Specs

Processor Information/General Information	
Machine:	Mac Quadra 800
Processor:	68040
Speed:	33MHz
Memory Information	
Memory-Logic Board:	8MB
SIMM Slots:	4
SIMM Type:	32-bit, 72-pin
Speed:	60ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	8, 12, 16, 20, 24, 28, 32, 36, 48, 52, 56, 60, 64, 68, 72, 76, 80, 84, 88, 92, 96, 108, 116, 132, 136MB
Video RAM Information	
Video RAM On-Board:	512K
VRAM Slots:	2
VRAM Type:	256K SIMM
Speed:	80ns or Faster
VRAM Configurations:	512K, 1MB
On-Board FPU:	Yes
On-Board Cache:	Yes, 8K
Expansion Slots:	3 NuBus & 1 68040 PDS Slot
Ethernet:	Optional

TechWorks Products	
Descriptions	**Part Number**
4MB SIMM	10373
8MB SIMM	10374
16MB SIMM	10799
32MB SIMM	10829
256K SIMM	10299

Mac Quadra 840AV

TECH SPECS

Processor Information/General Information	
Machine:	Mac Quadra 840AV
Processor:	68040
Speed:	40MHz
Memory Information	
Memory-Logic Board:	8MB (SIMMs)
SIMM Slots:	4
SIMM Type:	32-bit, 72-pin
Speed:	60ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	8 to 128MB of memory. Any combination of 4, 8, 16 and 32MB SIMM can be placed into the 4 SIMMs sockets. The machines come with one 8MB SIMM installed.
Video RAM Information	
Video RAM On-Board:	1MB
VRAM Slots:	4
VRAM Type:	256K SIMM
Speed:	80ns or Faster
VRAM Configurations:	1MB, 2MB
On-Board FPU:	Yes
On-Board Cache:	Yes, 8K
Expansion Slots:	3 NuBus
Ethernet:	Built-In, FriendlyNet Connection

TechWorks Products	
Descriptions	**Part Number**
4MB SIMM	10373
8MB SIMM	10374
16MB SIMM	10828
32MB SIMM	10829
256K VRAM SIMM	10299

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MAC QUADRA 900

TECH SPECS

Processor Information/General Information	
Machine:	Mac Quadra 900
Processor:	68040
Speed:	25MHz
Memory Information	
Memory-Logic Board:	8MB (SIMMs)
SIMM Slots:	16
SIMM Type:	8-bit, 30-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	4
Memory Configurations:	8 to 256MB
Video RAM Information	
Video RAM On-Board:	1MB
VRAM Slots:	4
VRAM Type:	256K SIMM
Speed:	80ns or Faster
VRAM Configurations:	1MB, 2MB
On-Board FPU:	Yes
On-Board Cache:	Yes, 8K
Expansion Slots:	6
Ethernet:	Built-In

TechWorks Products	
Descriptions	**Part Number**
1MB SIMM	10274
2MB SIMM	10291
4MB SIMM	10286
8MB SIMM	10726
16MB SIMM	10300
256K VRAM SIMM	10299

MAC QUADRA 950

TECH SPECS

Processor Information/General Information	
Machine:	Mac Quadra 950
Processor:	68040
Speed:	33MHz
Memory Information	
Memory-Logic Board:	8MB (SIMMs)
SIMM Slots:	16
SIMM Type:	8-bit, 30-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	4
Memory Configurations:	8 to 256MB
Video RAM Information	
Video RAM On-Board:	1MB
VRAM Slots:	4
VRAM Type:	256K SIMM
Speed:	80ns or Faster
VRAM Configurations:	1MB, 2MB
On-Board FPU:	Yes
On-Board Cache:	Yes, 8K
Expansion Slots:	6
Ethernet:	Built-In

TechWorks Products	
Descriptions	**Part Number**
1MB SIMM	10274
2MB SIMM	10291
4MB SIMM	10286
8MB SIMM	10726
16MB SIMM	10300
256K VRAM SIMM	10299

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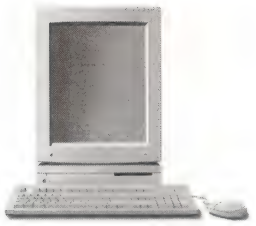
PERFORMA 200

TECH SPECS

Processor Information/General Information	
Machine:	Performa 200
Processor:	68030
Speed:	16MHz
Memory Information	
Memory-Logic Board:	2MB
SIMM Slots:	2
SIMM Type:	8-bit, 30-pin
Speed:	100ns or Faster
# of SIMMs Added @ a Time:	2
Memory Configurations:	2, 4, 6, 8, 10MB
Video RAM Information	
Video RAM On-Board:	N/A
VRAM Slots:	N/A
VRAM Type:	N/A
Speed:	N/A
VRAM Configurations:	N/A
On-Board FPU:	No, Upgrade Available
On-Board Cache:	No
Expansion Slots:	None
Ethernet:	SCSI Ethernet Adapter

TechWorks Products	
Descriptions	**Part Number**
1MB SIMM	10274
2MB SIMM	10291
4MB SIMM	10286
16MHz FPU	10334

PERFORMA 400



TECH SPECS

Processor Information/General Information	
Machine:	Performa 400
Processor:	68020
Speed:	16MHz
Memory Information	
Memory-Logic Board:	4MB
SIMM Slots:	2
SIMM Type:	8-bit, 30-pin
Speed:	100ns or Faster
# of SIMMs Added @ a Time:	2
Memory Configurations:	2, 4, 6, 10MB
Video RAM Information	
Video RAM On-Board:	256K
VRAM Slots:	1
VRAM Type:	256K SIMM
Speed:	100ns or Faster
VRAM Configurations:	256K, 512K
On-Board FPU:	No
On-Board Cache:	No
Expansion Slots:	1-PDS
Ethernet:	Ethernet Adapter Card

TechWorks Products	
Descriptions	**Part Number**
1MB SIMM	10274
2MB SIMM	10291
4MB SIMM	10286
256K VRAM SIMM	10299
16MHz FPU	10332

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PERFORMA 405

TECH SPECS

Processor Information/General Information	
Machine:	Performa 405
Processor:	68030
Speed:	16MHz
Memory Information	
Memory-Logic Board:	4MB
SIMM Slots:	2
SIMM Type:	8-bit, 30-pin
Speed:	100ns or Faster
# of SIMMs Added @ a Time:	2
Memory Configurations:	4, 6, 10MB
Video RAM Information	
Video RAM On-Board:	256K
VRAM Slots:	1
VRAM Type:	512K SIMM
Speed:	100ns or Faster
VRAM Configurations:	256K, 512K
On-Board FPU:	No, Upgrade Available
On-Board Cache:	No
Expansion Slots:	1-PDS
Ethernet:	Ethernet Adapter Card

TechWorks Products	
Descriptions	**Part Number**
1MB SIMM	10274
2MB SIMM	10291
4MB SIMM	10286
512K VRAM SIMM	10288
16MHz FPU	10332

PERFORMA 410

TECH SPECS

Processor Information/General Information	
Machine:	Performa 410
Processor:	68030
Speed:	16MHz
Memory Information	
Memory-Logic Board:	4MB
SIMM Slots:	2
SIMM Type:	8-bit, 30-pin
Speed:	100ns or Faster
# of SIMMs added @ a Time:	2
Memory Configurations:	4, 6, 10MB
Video RAM Information	
Video RAM On Board:	256K
VRAM Slots:	1
VRAM Type:	512K SIMM
Speed:	100ns or Faster
VRAM Configurations:	256K, 512K
On-Board FPU:	No, Upgrades Available
On-Board Cache:	No
Expansion Slots:	1-PDS
Ethernet:	Ethernet Adapter Card

TechWorks Products	
Descriptions	**Part Number**
1MB SIMM	10274
2MB SIMM	10291
4MB SIMM	10286
512K VRAM SIMM	10288
16MHz FPU	10332

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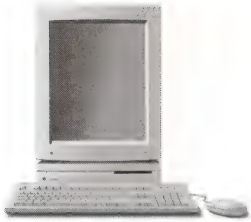
PERFORMA 430

TECH SPECS

Processor Information/General Information	
Machine:	Performa 430
Processor:	68030
Speed:	16MHz
Memory Information	
Memory-Logic Board:	4MB
SIMM Slots:	2
SIMM Type:	8-bit, 30-pin
Speed:	100ns or Faster
# of SIMMs Added @ a Time:	2
Memory Configurations:	4, 6, 10MB
Video RAM Information	
Video RAM On-Board:	512K
VRAM Slots:	1
VRAM Type:	256K SIMM
Speed:	100ns or Faster
VRAM Configurations:	512K, 768K
On-Board FPU:	No, Upgrade Available
On-Board Cache:	No
Expansion Slots:	1-PDS
Ethernet:	Ethernet Adapter Card

TechWorks Products	
Descriptions	**Part Number**
1MB SIMM	10274
2MB SIMM	10291
4MB SIMM	10286
256K VRAM SIMM	10299
16MHz FPU	10332

PERFORMA 450



TECH SPECS

Processor Information/General Information	
Machine:	Performa 450
Processor:	68030
Speed:	25MHz
Memory Information	
Memory-Logic Board:	4MB
SIMM Slots:	1
SIMM Type:	32-bit, 72-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	4, 5, 6, 8, 12, 20, 36MB
Video RAM Information	
Video RAM On-Board:	512K
VRAM Slots:	1
VRAM Type:	256K SIMM
Speed:	100ns or Faster
VRAM Configurations:	512K, 768K
On-Board FPU:	No, Upgrade Available
On-Board Cache:	No
Expansion Slots:	1-PDS
Ethernet:	Ethernet Adapter Card

TechWorks Products	
Descriptions	**Part Number**
4MB SIMM	10373
8MB SIMM	10374
16MB SIMM (Non-Composite)	10828
32MB SIMM	10829
256K VRAM SIMM	10299
25 MHz 68882 FPU	10567

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PERFORMA 460, 466, 467

TECH SPECS

Processor Information/General Information	
Machine:	Performa 460, 466, 467
Processor:	68030
Speed:	33MHz
Memory Information	
Memory-Logic Board:	4MB
SIMM Slots:	1
SIMM Type:	32-bit, 72-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	5, 8, 12, 20, 36MB
Video RAM Information	
Video RAM On-Board:	512K
VRAM Slots:	1
VRAM Type:	256K SIMM
Speed:	80ns or Faster
VRAM Configurations:	512K, 768K
On-Board FPU:	Optional
On-Board Cache:	No
Expansion Slots:	1-PDS
Ethernet:	Ethernet Adapter Card

TechWorks Products	
Descriptions	**Part Number**
2MB SIMM	10280
4MB SIMM	10373
8MB SIMM	10374
16MB SIMM	10828
32MB SIMM	10829
256K VRAM SIMM	10299
25MHz FPU	10567-0005

PERFORMA 475

TECH SPECS

Processor Information/General Information	
Machine:	Performa 475
Processor:	68040
Speed:	25MHz
Memory Information	
Memory-Logic Board:	4MB
SIMM Slots:	1
SIMM Type:	32-bit, 72-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	4, 5, 6, 8, 12, 20, 36MB
Video RAM Information	
Video RAM On-Board:	512K
VRAM Slots:	2
VRAM Type:	512K SIMM
Speed:	80ns or Faster
VRAM Configurations:	512K, 1MB
On-Board FPU:	Optional
On-Board Cache:	No
Expansion Slots:	1-PDS
Ethernet:	Ethernet Adapter Card

TechWorks Products	
Descriptions	**Part Number**
1MB SIMM	10280
4MB SIMM	10373
8MB SIMM	10374
16MB SIMM	10828
32MB SIMM	10829
512K VRAM SIMM	10288
25MHz FPU	10567

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PERFORMA 476

TECH SPECS

Processor Information/General Information	
Machine:	Performa 476
Processor:	68040
Speed:	25MHz
Memory Information	
Memory-Logic Board:	4 MB
SIMM Slots:	1
SIMM Type:	32-bit, 72-pin
Speed:	80ns
# of SIMMs added @ a Time:	1
Memory Configurations:	4, 5, 6, 8, 12, 20, 36MB
Video RAM Information	
Video RAM On Board:	512K
VRAM Slots:	2
VRAM Type:	512K SIMM
Speed:	80ns or Faster
VRAM Configurations:	512K, 1MB
On-Board FPU:	Optional
On-Board Cache:	No
Expansion Slots:	1-PDS
Ethernet:	Ethernet Adapter Card

TechWorks Products	
Descriptions	**Part Number**
1MB SIMM	10280
4MB SIMM	10373
8MB SIMM	10374
16MB SIMM	10828
32MB SIMM	10829
512K VRAM SIMM	10288
25MHz FPU	10567

PERFORMA 550

TECH SPECS

Processor Information/General Information	
Machine:	Performa 550
Processor:	68030
Speed:	33MHz
Memory Information	
Memory-Logic Board:	5MB (SIMMs)
SIMM Slots:	1
SIMM Type:	32-bit, 72-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	5, 8, 12, 20, 36MB
Video RAM Information	
Video RAM On-Board:	512K
VRAM Slots:	1
VRAM Type:	256K SIMM
Speed:	80ns or Faster
VRAM Configurations:	512K, 768K
On-Board FPU:	No, Upgrade Available
On-Board Cache:	No
Expansion Slots:	1-PDS
Ethernet:	Ethernet Adapter Card

TechWorks Products	
Descriptions	**Part Number**
1MB SIMM	10280
4MB SIMM	10373
8MB SIMM	10374
16MB SIMM	10828
32MB SIMM	10829
256K VRAM SIMM	10299
25MHz FPU	10567-0005

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PERFORMA 600

TECH SPECS

Processor Information/General Information	
Machine:	Performa 600
Processor:	68030
Speed:	33MHz
Memory Information	
Memory-Logic Board:	4MB
SIMM Slots:	4
SIMM Type:	8-bit, 30-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	4
Memory Configurations:	4, 5, 8, 20, 36, 68MB
Video RAM Information	
Video RAM On-Board:	512K
VRAM Slots:	2
VRAM Type:	512K SIMM
Speed:	80ns or Faster
VRAM Configurations:	512K, 1MB
On-Board FPU:	Yes
On-Board Cache:	Yes, 32K
Expansion Slots:	1-PDS, 3-NuBus Slots
Ethernet:	N/A

TechWorks Products	
Descriptions	**Part Number**
1MB SIMM	10274
4MB SIMM	10286
16MB SIMM	10300
512K VRAM SIMM	10288

PowerBook 100

TECH SPECS

Processor Information/General Information	
Machine:	PowerBook 100
Processor:	68000
Speed:	16MHz
Memory Information	
Memory-Logic Board:	2MB
SIMM Slots:	1
SIMM Type:	Expansion Card
Speed:	100ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	2, 4, 6, 8MB
Video RAM Information	
Video RAM On-Board:	N/A
VRAM Slots:	N/A
VRAM Type:	N/A
Speed:	N/A
VRAM Configurations:	N/A
On-Board FPU:	No
On-Board Cache:	No
Expansion Slots:	None
Ethernet:	SCSI Ethernet Adapter

TechWorks Products	
Descriptions	**Part Number**
2MB PowerRAM® Upgrade	10321
4MB PowerRAM Upgrade	10324
6MB PowerRAM Upgrade	10325

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PowerBook 140

TECH SPECS

Processor Information/General Information	
Machine:	PowerBook 140
Processor:	68030
Speed:	16MHz
Memory Information	
Memory-Logic Board:	2MB
SIMM Slots:	1
SIMM Type:	Expansion Card
Speed:	100ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	2, 4, 6, 8MB
Video RAM Information	
Video RAM On-Board:	N/A
VRAM Slots:	N/A
VRAM Type:	N/A
Speed:	N/A
VRAM Configurations:	N/A
On-Board FPU:	No
On-Board Cache:	No
Expansion Slots:	None
Ethernet:	SCSI Ethernet Adapter

TechWorks Products	
Descriptions	**Part Number**
2MB PowerRAM Upgrade	10321
4MB PowerRAM Upgrade	10322
6MB PowerRAM Upgrade	10323

PowerBook 145

TECH SPECS

Processor Information/General Information	
Machine:	PowerBook 145
Processor:	68030
Speed:	25MHz
Memory Information	
Memory-Logic Board:	4MB
SIMM Slots:	1
SIMM Type:	Expansion Card
Speed:	100ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	4, 6, 8MB
Video RAM Information	
Video RAM On-Board:	N/A
VRAM Slots:	N/A
VRAM Type:	N/A
Speed:	N/A
VRAM Configurations:	N/A
On-Board FPU:	No
On-Board Cache:	No
Expansion Slots:	None
Ethernet:	SCSI Ethernet Adapter

TechWorks Products	
Descriptions	**Part Number**
2MB PowerRAM Upgrade	10321
4MB PowerRAM Upgrade	10322
6MB PowerRAM Upgrade	10323

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PowerBook 145B

TECH SPECS

Processor Information/General Information	
Machine:	PowerBook 145B
Processor:	68030
Speed:	25MHz
Memory Information	
Memory-Logic Board:	4MB
SIMM Slots:	1
SIMM Type:	Expansion Card
Speed:	100ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	4, 6, 8MB
Video RAM Information	
Video RAM On-Board:	N/A
VRAM Slots:	N/A
VRAM Type:	N/A
Speed:	N/A
VRAM Configurations:	N/A
On-Board FPU:	No
On-Board Cache:	No
Expansion Slots:	None
Ethernet:	SCSI Ethernet Adapter

TechWorks Products	
Descriptions	**Part Number**
2MB PowerRAM Upgrade	10321
4MB PowerRAM Upgrade	10322
6MB PowerRAM Upgrade	10323

PowerBook 160

TECH SPECS

Processor Information/General Information	
Machine:	PowerBook 160
Processor:	68030
Speed:	25MHz
Memory Information	
Memory-Logic Board:	4MB
SIMM Slots:	1
SIMM Type:	Expansion Card
Speed:	85ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	4, 6, 8, 10, 12, 14MB
Video RAM Information	
Video RAM On-Board:	N/A
VRAM Slots:	N/A
VRAM Type:	N/A
Speed:	N/A
VRAM Configurations:	N/A
On-Board FPU:	Yes
Cache On-Board:	No
Expansion Slots:	None
Ethernet:	SCSI Ethernet Adapter

TechWorks Products	
Descriptions	**Part Number**
2MB PowerRAM Upgrade	10656-0001
4MB PowerRAM Upgrade	10656-0002
6MB PowerRAM Upgrade	10656-0003
8MB PowerRAM Upgrade	10656-0004
10MB PowerRAM Upgrade	10656-0005

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PowerBook 165

TECH SPECS

Processor Information/General Information	
Machine:	PowerBook 165
Processor:	68030
Speed:	33MHz
Memory Information	
Memory-Logic Board:	4MB
SIMM Slots:	1
SIMM Type:	Expansion Card
Speed:	85ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	4, 6, 8, 10, 12, 14MB
Video RAM Information	
Video RAM On-Board:	N/A
VRAM Slots:	N/A
VRAM Type:	N/A
Speed:	N/A
VRAM Configurations:	N/A
On-Board FPU:	Yes
Cache On-Board:	No
Expansion Slots:	None
Ethernet:	SCSI Ethernet Adapter

TechWorks Products	
Descriptions	**Part Number**
2MB PowerRAM Upgrade	10656-0001
4MB PowerRAM Upgrade	10656-0002
6MB PowerRAM Upgrade	10656-0003
8MB PowerRAM Upgrade	10656-0004
10MB PowerRAM Upgrade	10656-0005

PowerBook 165c

TECH SPECS

Processor Information/General Information	
Machine:	PowerBook 165c
Processor:	68030
Speed:	33MHz
Memory Information	
Memory-Logic Board:	4MB
SIMM Slots:	1
SIMM Type:	Expansion Card
Speed:	85ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	4, 6, 8, 10, 12, 14MB
Video RAM Information	
Video RAM On-Board:	N/A
VRAM Slots:	N/A
VRAM Type:	N/A
Speed:	N/A
VRAM Configurations:	N/A
On-Board FPU:	Yes
On-Board Cache:	No
Expansion Slots:	None
Ethernet:	SCSI Ethernet Adapter

TechWorks Products	
Descriptions	**Part Number**
2MB PowerRAM Upgrade	10727-0001
4MB PowerRAM Upgrade	10727-0002
6MB PowerRAM Upgrade	10727-0003
8MB PowerRAM Upgrade	10727-0004
10MB PowerRAM Upgrade	10727-0005

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PowerBook 170

TECH SPECS

Processor Information/General Information	
Machine:	PowerBook 170
Processor:	68030
Speed:	25MHz
Memory Information	
Memory-Logic Board:	2MB
SIMM Slots:	1
SIMM Type:	Expansion Card
Speed:	100ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	2, 4, 6, 8MB
Video RAM Information	
Video RAM On-Board:	N/A
VRAM Slots:	N/A
VRAM Type:	N/A
Speed:	N/A
VRAM Configurations:	N/A
On-Board FPU:	Yes
On-Board Cache:	No
Expansion Slots:	None
Ethernet:	SCSI Ethernet Adapter

TechWorks Products	
Descriptions	**Part Number**
2MB PowerRAM Upgrade	10321
4MB PowerRAM Upgrade	10322
6MB PowerRAM Upgrade	10323

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PowerBook 180

Tech Specs

Processor Information/General Information	
Machine:	PowerBook 180
Processor:	68030
Speed:	33MHz
Memory Information	
Memory-Logic Board:	4MB
SIMM Slots:	1
SIMM Type:	Expansion Card
Speed:	85ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	4, 6, 8, 10, 12, 14MB
Video RAM Information	
Video RAM On-Board:	N/A
VRAM Slots:	N/A
VRAM Type:	N/A
Speed:	N/A
VRAM Configurations:	N/A
On-Board FPU:	Yes
On-Board Cache:	No
Expansion Slots:	None
Ethernet:	SCSI Ethernet Adapter

TechWorks Products	
Descriptions	**Part Number**
2MB PowerRAM Upgrade	10656-0001
4MB PowerRAM Upgrade	10656-0002
6MB PowerRAM Upgrade	10656-0003
8MB PowerRAM Upgrade	10656-0004
10MB PowerRAM Upgrade	10656-0005

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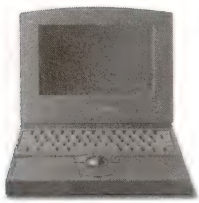
PowerBook 180c

Tech Specs

Processor Information/General Information	
Machine:	PowerBook 180c
Processor:	68030
Speed:	33MHz
Memory Information	
Memory-Logic Board:	4MB
SIMM Slots:	1
SIMM Type:	Expansion Card
Speed:	85ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	4, 6, 8, 10, 12, 14MB
Video RAM Information	
Video RAM On-Board:	N/A
VRAM Slots:	N/A
VRAM Type:	N/A
Speed:	N/A
VRAM Configurations:	N/A
On-Board FPU:	Yes
On-Board Cache:	No
Expansion Slots:	None
Ethernet:	SCSI Ethernet Adapter

TechWorks Products	
Descriptions	**Part Number**
2MB PowerRAM Upgrade	10727-0001
4MB PowerRAM Upgrade	10727-0002
6MB PowerRAM Upgrade	10727-0003
8MB PowerRAM Upgrade	10727-0004
10MB PowerRAM Upgrade	10727-0005

PowerBook Duo 210



TECH SPECS

Processor Information General Information	
Machine:	PowerBook Duo 210
Processor:	68030
Speed:	25MHz
Memory Information	
Memory-Logic Board:	4MB
SIMM Slots:	1
SIMM Type:	Expansion Card
Speed:	70ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	4, 6, 8, 10, 12, 16, 24MB
Video RAM Information	
Video RAM On-Board:	N/A
VRAM Slots:	N/A
VRAM Type:	N/A
Speed:	N/A
VRAM Configurations:	N/A
On-Board FPU:	No
On-Board Cache:	No
Expansion Slots:	None
Ethernet:	SCSI Ethernet Adapter

TechWorks Products	
Descriptions	**Part Number**
2MB PowerRAM Upgrade	10632-0001
4MB PowerRAM Upgrade	10632-0002
6MB PowerRAM Upgrade	10632-0003
8MB PowerRAM Upgrade	10632-0004
12MB PowerRAM Upgrade	10632-0005
20MB PowerRAM Upgrade	10632-0006

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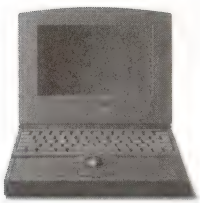
PowerBook Duo 230



TECH SPECS

Processor Information/General Information	
Machine:	PowerBook Duo 230
Processor:	68030
Speed:	33MHz
Memory Information	
Memory-Logic Board:	4MB
SIMM Slots:	1
SIMM Type:	Expansion Card
Speed:	70ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	4, 6, 8, 10, 12, 16, 24MB
Video RAM Information	
Video RAM On-Board:	N/A
VRAM Slots:	N/A
VRAM Type:	N/A
Speed:	N/A
VRAM Configurations:	N/A
On-Board FPU:	No
On-Board Cache:	No
Expansion Slots:	None
Ethernet:	SCSI Ethernet Adapter

TechWorks Products	
Descriptions	**Part Number**
2MB PowerRAM Upgrade	10632-0001
4MB PowerRAM Upgrade	10632-0002
6MB PowerRAM Upgrade	10632-0003
8MB PowerRAM Upgrade	10632-0004
12MB PowerRAM Upgrade	10632-0005
20MB PowerRAM Upgrade	10632-0006

PowerBook Duo 250

TECH SPECS

Processor Information/General Information	
Machine:	PowerBook Duo 250
Processor:	68030
Speed:	33MHz
Memory Information	
Memory-Logic Board:	4MB
SIMM Slots:	1
SIMM Type:	Expansion Card
Speed:	70ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	4, 6, 8, 10, 12, 16, 24MB
Video RAM Information	
Video RAM On-Board:	N/A
VRAM Slots:	N/A
VRAM Type:	N/A
Speed:	N/A
VRAM Configurations:	N/A
On-Board FPU:	No
On-Board Cache:	No
Expansion Slots:	None
Ethernet:	SCSI Ethernet Adapter

TechWorks Products	
Descriptions	**Part Number**
2MB PowerRAM Upgrade	10632-0001
4MB PowerRAM Upgrade	10632-0002
6MB PowerRAM Upgrade	10632-0003
8MB PowerRAM Upgrade	10632-0004
12MB PowerRAM Upgrade	10632-0005
20MB PowerRAM Upgrade	10632-0006

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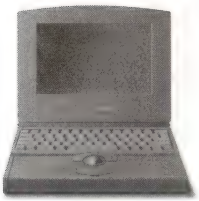
PowerBook Duo 270c



TECH SPECS

Processor Information/General Information	
Machine:	PowerBook Duo 270c
Processor:	68030
Speed:	33MHz
Memory Information	
Memory-Logic Board:	4MB
SIMM Slots:	1
SIMM Type:	Expansion Card
Speed:	70ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	4, 6, 8, 10, 12, 16, 24, 32MB
Video RAM Information	
Video RAM On-Board:	N/A
VRAM Slots:	N/A
VRAM Type:	N/A
Speed:	N/A
VRAM Configurations:	N/A
On-Board FPU:	Yes
On-Board Cache:	No
Expansion Slots:	None
Ethernet:	SCSI Ethernet Adapter

TechWorks Products	
Descriptions	**Part Number**
2MB PowerRAM Upgrade	10632-0001
4MB PowerRAM Upgrade	10632-0002
6MB PowerRAM Upgrade	10632-0003
8MB PowerRAM Upgrade	10632-0004
12MB PowerRAM Upgrade	10632-0005
20MB PowerRAM Upgrade	10632-0006
28MB PowerRAM Upgrade	Pending

NEWTON

TECH SPECS

Processor Information/General Information	
Machine:	Newton
Processor:	ARM 610 RISC
Speed:	N/A
Memory Information	
Memory-Logic Board:	2.5MB
Expansion Slots:	1
Slot Type:	PCMCIA Type II Flash or Static RAM Card
Speed:	N/A
Memory Configurations:	512K, 1MB, 1.5MB, 2MB, 2.5MB
Video RAM Information	
Video RAM On-Board:	N/A
VRAM Slots:	N/A
VRAM Type:	N/A
Speed:	N/A
VRAM Configurations:	N/A
On-Board FPU:	N/A
On-Board Cache:	N/A

TechWorks Products	
Descriptions	**Part Number**
256K Static RAM Card	Pending
512K Static RAM Card	Pending
1MB Static RAM Card	Pending
2MB Static RAM Card	Pending

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Personal LaserWriter NT

Tech Specs

Processor Information/General Information	
Machine:	Personal LaserWriter NT
Processor:	68000
Speed:	12MHz
Memory Information	
Memory-Logic Board:	2MB (SIMMs)
SIMM Slots:	2
SIMM Type:	8-bit, 30-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	2
Memory Configurations:	2, 8MB
Video RAM Information	
Resolution:	300 Dots Per Inch
Printing Speed:	8 Pages Per Minute
On-Board FPU:	No
On-Board Cache:	No
Expansion Slots:	None

TechWorks Products	
Descriptions	**Part Number**
4MB SIMM	10286

Personal LaserWriter 300

Tech Specs

Processor Information/General Information	
Machine:	Personal LaserWriter 300
Processor:	ASIC
Speed:	—
Memory Information	
Memory-Logic Board:	512K
SIMM Slots:	1
SIMM Type:	8-bit, 30-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	512K, 1.5MB, 4.5MB
Video RAM Information	
Resolution:	300 Dots Per Inch
Printing Speed:	4 Pages Per Minute
On-Board FPU:	No
On-Board Cache:	No
Expansion Slots:	None

TechWorks Products	
Descriptions	**Part Number**
1MB SIMM	10274
4MB SIMM	10286

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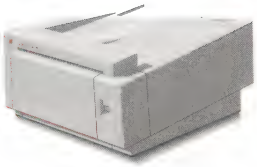
PERSONAL LASERWRITER NTR

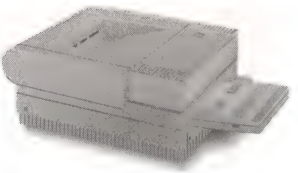


TECH SPECS

Processor Information/General Information	
Machine:	Personal LaserWriter NTR
Processor:	AMD 29005 RISC
Speed:	16MHz
Memory Information	
Memory-Logic Board:	3MB (SIMMs)
SIMM Slots:	1
SIMM Type:	32-bit, 72-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	3, 4MB
Video RAM Information	
Resolution:	300 Dots Per Inch
Printing Speed:	4 Pages Per Minute
On-Board FPU:	No
On-Board Cache:	No
Expansion Slots:	None

TechWorks Products	
Descriptions	**Part Number**
2MB SIMM	10280

LASERWRITER IINTX



TECH SPECS

Processor Information/General Information	
Machine:	LaserWriter IINTX
Processor:	68020
Speed:	16MHz
Memory Information	
Memory-Logic Board:	2MB (SIMMs)
SIMM Slots:	12
SIMM Type:	8-bit, 30-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	4
Memory Configurations:	2, 3, 4, 5, 8, 9, 12MB
Video RAM Information	
Resolution:	300 Dots Per Inch
Printing Speed:	8 Pages Per Minute
On-Board FPU:	No
On-Board Cache:	No
Expansion Slots:	None

TechWorks Products	
Descriptions	**Part Number**
1MB SIMM	10278

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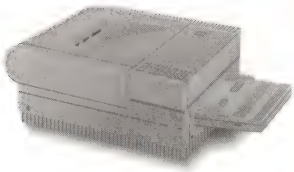
LaserWriter IIf

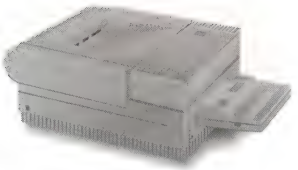


Tech Specs

Processor Information/General Information	
Machine:	LaserWriter IIf
Processor:	68030
Speed:	20MHz
Memory Information	
Memory-Logic Board:	4MB (SIMMs)
SIMM Slots:	8
SIMM Type:	8-bit, 30-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	4
Memory Configurations:	4, 8, 12, 16, 24, 32MB
Video RAM Information	
Resolution:	300 Dots Per Inch
Printing Speed:	8 Pages Per Minute
On-Board FPU:	No
On-Board Cache:	No
Expansion Slots:	None

TechWorks Products	
Descriptions	**Part Number**
1MB SIMM	10274
4MB SIMM	10286

LaserWriter IIg



TECH SPECS

Processor Information/General Information	
Machine:	LaserWriter IIg
Processor:	68030
Speed:	25MHz
Memory Information	
Memory-Logic Board:	8MB (SIMMs)
SIMM Slots:	8
SIMM Type:	8-bit, 30-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	8
Memory Configurations:	8, 12, 16, 24, 32MB
Video RAM Information	
Resolution:	300 Dots Per Inch
Printing Speed:	8 Pages Per Minute
On-Board FPU:	No
On-Board Cache:	No
Expansion Slots:	None

TechWorks Products	
Descriptions	**Part Number**
1MB SIMM	10274
4MB SIMM	10286

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LaserWriter Select 300

TECH SPECS

Processor Information/General Information	
Machine:	LaserWriter Select 300
Processor:	ASIC
Speed:	—
Memory Information	
Memory-Logic Board:	512K
SIMM Slots:	1
SIMM Type:	32-bit, 72-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	512K, 1.5MB, 4.5MB
Video RAM Information	
Resolution:	300 Dots Per Inch
Printing Speed:	5 Pages Per Minute
On-Board FPU:	No
On-Board Cache:	No
Expansion Slots:	None

TechWorks Products	
Descriptions	**Part Number**
1MB SIMM	10274
4MB SIMM	10286

LaserWriter Select 310

TECH SPECS

Processor Information/General Information	
Machine:	LaserWriter Select 310
Processor:	AMD 29205 RISC
Speed:	16MHz
Memory Information	
Memory-Logic Board:	1.5MB (SIMMs)
SIMM Slots:	1
SIMM Type:	32-bit, 72-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	1.5, 5.5MB
Video RAM Information	
Resolution:	300 Dots Per Inch
Printing Speed:	5 Pages Per Minute
On-Board FPU:	No
On-Board Cache:	No
Expansion Slots:	None

TechWorks Products	
Descriptions	**Part Number**
4MB SIMM	10373

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LaserWriter Select 360

TECH SPECS

Processor Information/General Information	
Machine:	LaserWriter Select 360
Processor:	AMD 29005 RISC
Speed:	16MHz
Memory Information	
Memory-Logic Board:	7MB (SIMMs)
SIMM Slots:	1
SIMM Type:	32-bit, 72-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	7, 16MB
Video RAM Information	
Resolution:	600 Dots Per Inch
Printing Speed:	10 Pages Per Minute
On-Board FPU:	No
On-Board Cache:	No
Expansion Slots:	None

TechWorks Products	
Descriptions	**Part Number**
16MB SIMM	10828

LaserWriter Pro 600

Tech Specs

Processor Information/General Information	
Machine:	LaserWriter Pro 600
Processor:	68030
Speed:	25MHz
Memory Information	
Memory-Logic Board:	4MB (SIMMs)
SIMM Slots:	2
SIMM Type:	32-bit, 72-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	4, 8, 12, 16, 24, 32MB
Video RAM Information	
Resolution:	300 Dots Per Inch
Printing Speed:	8 Pages Per Minute
On-Board FPU:	No
On-Board Cache:	No
Expansion Slots:	None

TechWorks Products	
Descriptions	**Part Number**
4MB SIMM	10373
8MB SIMM	10374
16MB SIMM	10828

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LaserWriter Pro 630

TECH SPECS

Processor Information/General Information	
Machine:	LaserWriter Pro 630
Processor:	68030
Speed:	25MHz
Memory Information	
Memory-Logic Board:	8MB (SIMMs)
SIMM Slots:	2
SIMM Type:	32-bit, 72-pin
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	8, 16, 20, 32MB
Video RAM Information	
Resolution:	300 Dots Per Inch
Printing Speed:	8 Pages Per Minute
On-Board FPU:	No
On-Board Cache:	No
Expansion Slots:	None

TechWorks Products	
Descriptions	**Part Number**
4MB Upgrade	10373
8MB Upgrade	10374
16MB Upgrade	10828

LaserWriter Pro 810

TECH SPECS

Processor Information/General Information	
Machine:	LaserWriter Pro 810
Processor:	Weitek 8200 RISC
Speed:	7.25MHz
Memory Information	
Memory-Logic Board:	8MB (SIMMs)
SIMM Slots:	4
SIMM Type:	Expansion Card
Speed:	80ns or Faster
# of SIMMs Added @ a Time:	1
Memory Configurations:	8, 12, 16, 24, 32MB
Video RAM Information	
Resolution:	300, 4000, 600 or 800 Dots Per Inch
Printing Speed:	10 Pages Per Minute
On-Board FPU:	No
On-Board Cache:	No
Expansion Slots:	None

TechWorks Products	
Descriptions	**Part Number**
Memory Expansion Card	Pending

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